

Evaluation of Different Hearing Aid Couplings in Every Day Life with Ecological Momentary Assessment (EMA)

Sivantos
the hearing company

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Motivation: Open or closed coupling?

- Closed coupling**

 - Noise reduction and directional microphone more effective
 - Better feedback stability
→ more gain applicable
- Open or semi-open coupling**

 - Less occlusion
 - Sound seems more natural
 - Used in ~2/3 of all fitting sessions with Signia hearing aids

What do subjects prefer in every day life?

Ecological Momentary Assessment

What is it?

- Smartphone based surveys
- In the current situation
- Several times per day

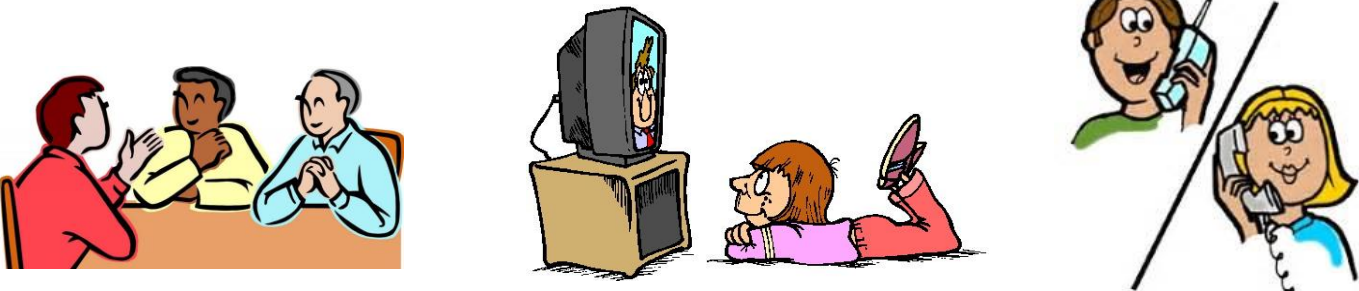
What are the advantages?



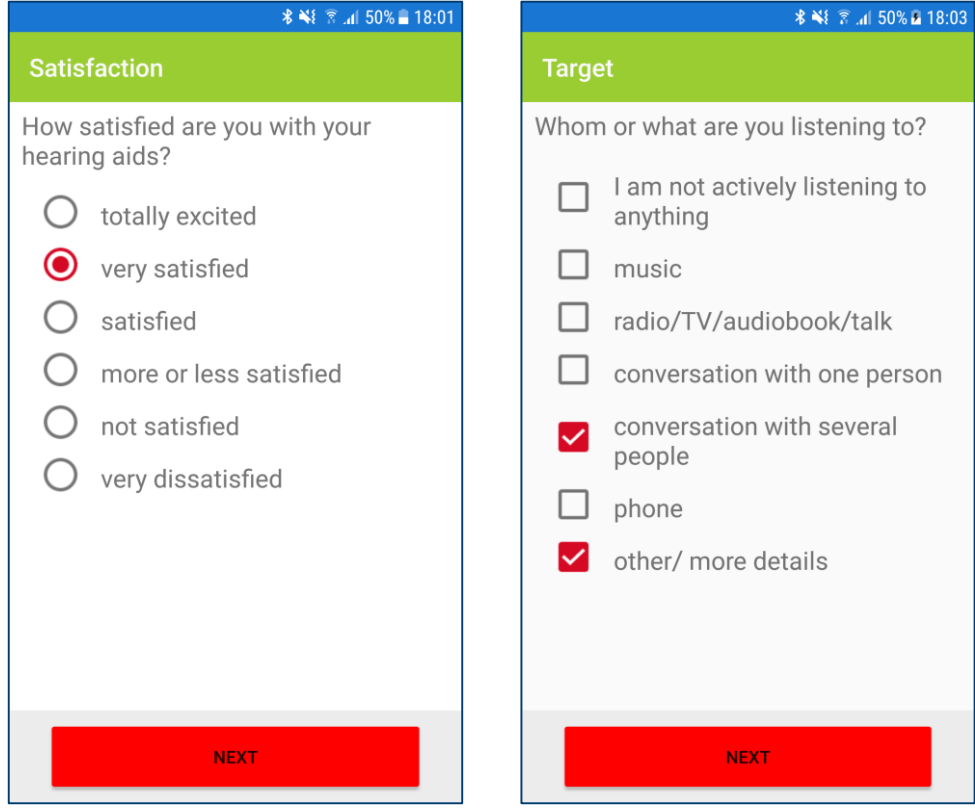
Representative for real life



No memory bias



Context sensitive



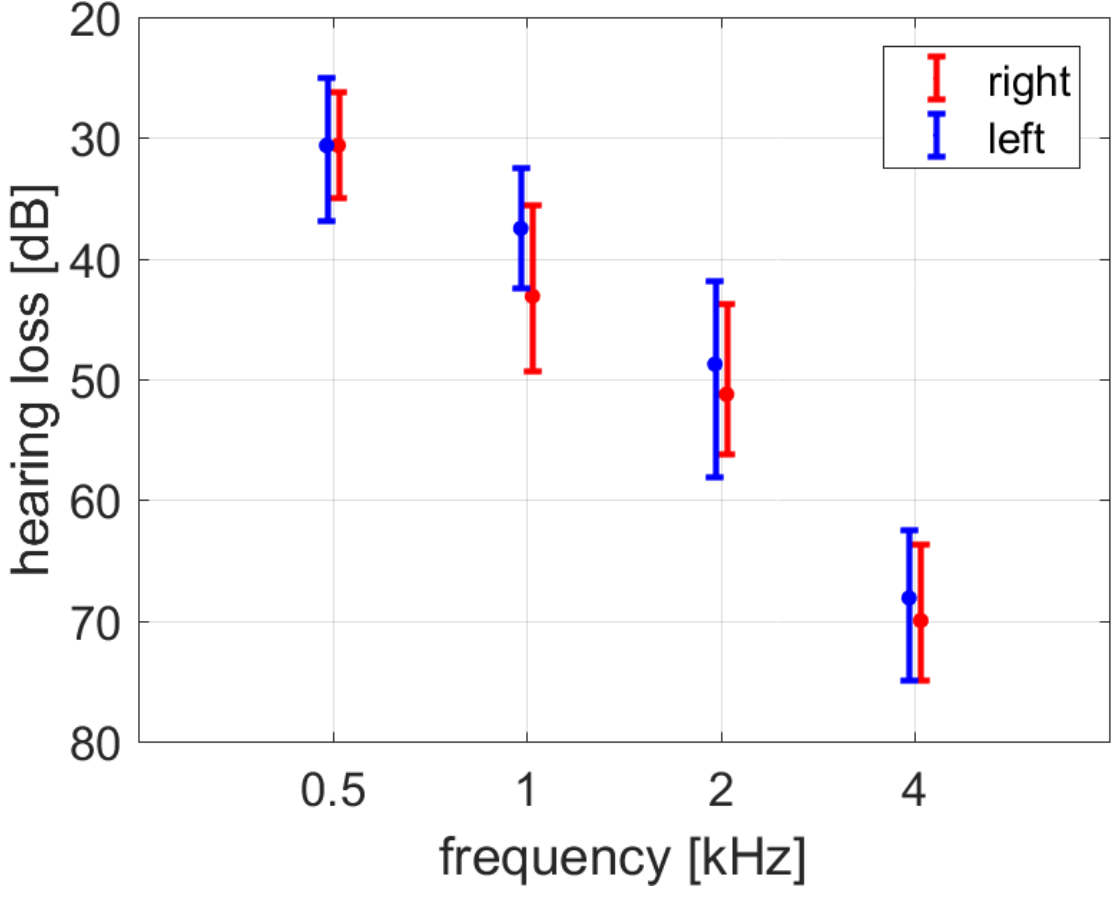
Experimental Methods

Subjects:

- N = 11, ≥ 6 years experience
- Age: 69 – 79 years, (mean 72.7 years, SD 5.1 years)
- Mean HL (0.5, 1, 2, 4) = 47 dB HL (SD: 13 dB HL)

Hearing aids:

- Pure 13 7Nx M hearing aids, with first fit and own voice processing
- Open domes, click sleeves closed, individual click molds (vent 0.8 mm)



The App:

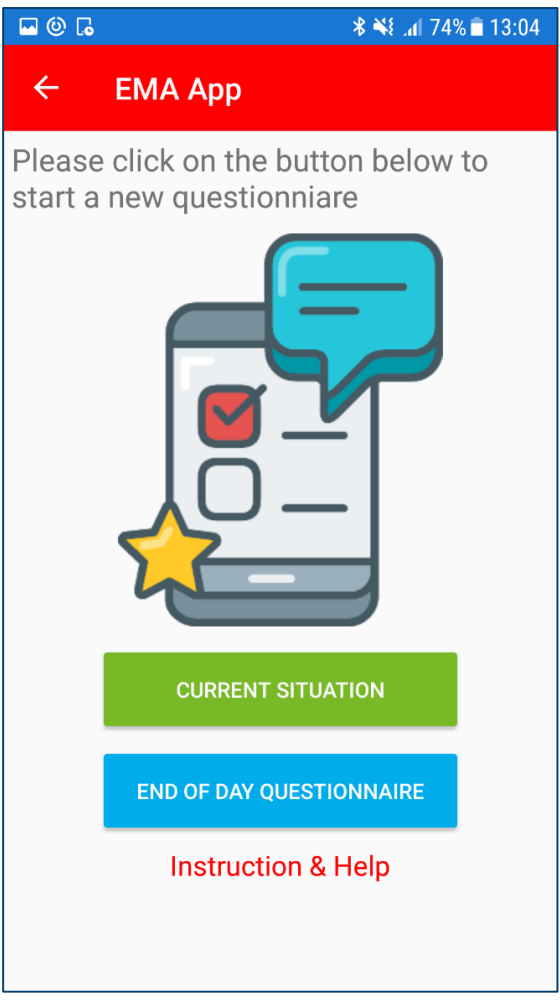
- 8 random triggers per day
- User-triggered questionnaires (5 per day recommended)

Short mandatory questionnaire:

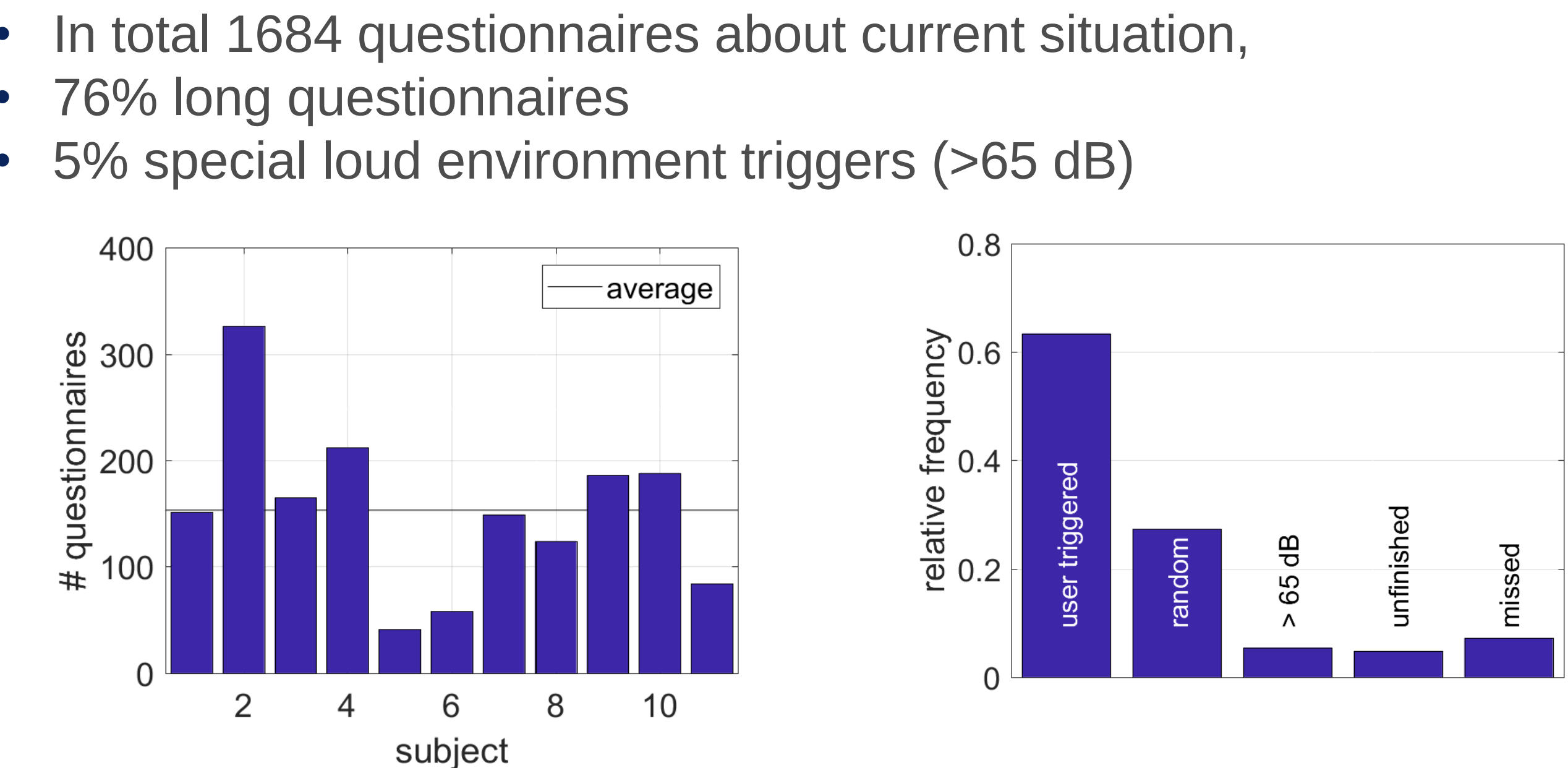
- satisfaction, target, background noise

Long optional questionnaire:

- understanding, listening effort, sound quality, background level, sound localization, free comment



Results: EMA Participation

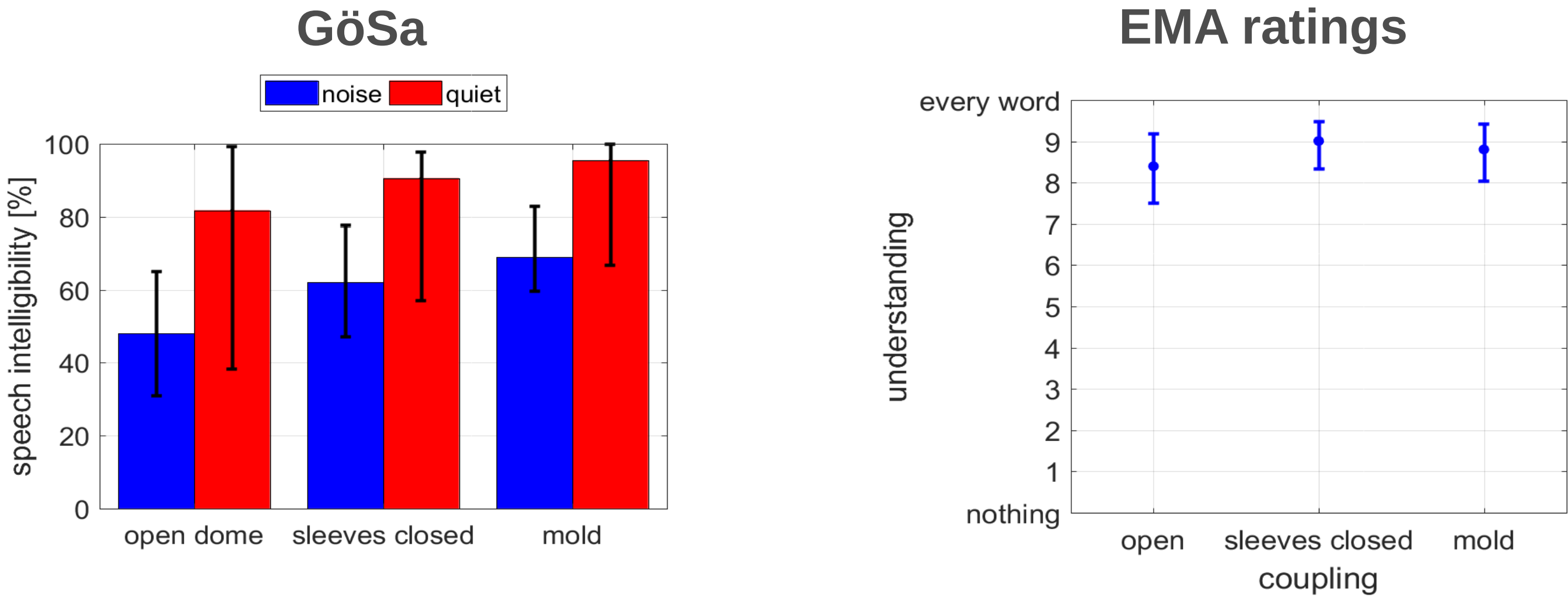


When pooling over all questionnaires, not every subject represented equally ~2/3 user triggered questionnaires (comparable to Kerner et al. 2018)

Main reasons for not answering: inappropriate in that situation or not heard

Results: Speech understanding

A Göttingen sentence test (GöSa) was performed in quiet (target sound at 55 dB) and in noise (SNR= -4dB, IFnoise at 65 dB).

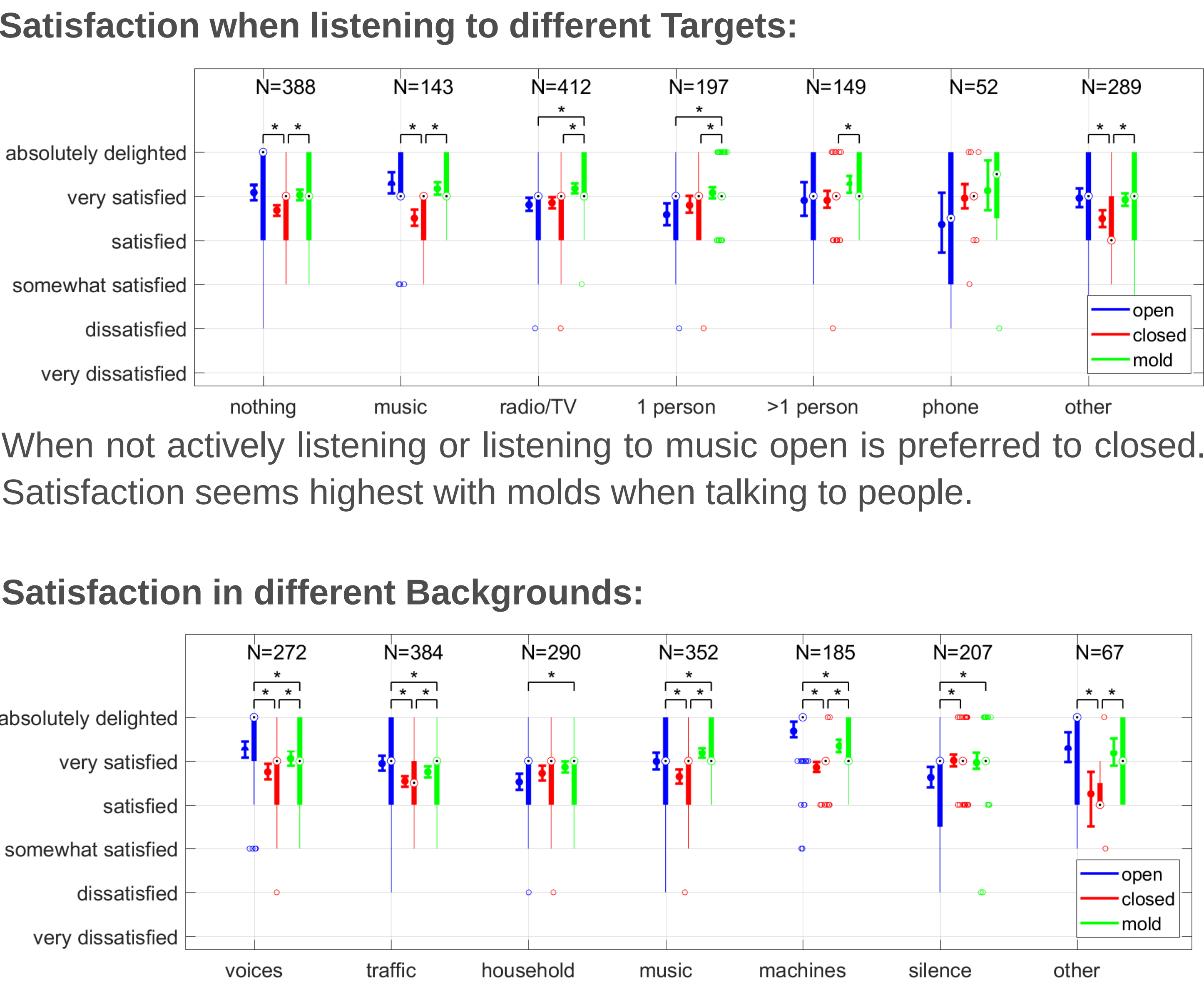


In both, noise and quiet, speech understanding is significantly better with click molds or click sleeves closed than with open domes (p<0.05, paired sample permutation test using bootstrapping). The same trend is visible in the subjective ratings, but the only significant difference in mean ratings is between open domes and closed click sleeves.

Results: Satisfaction

- No significant difference in overall satisfaction for the three couplings.
- Significant correlations between differences in mean satisfaction ratings and sound quality ($\rho_{\text{open-closed}}=0.97$, $\rho_{\text{open-mold}}=0.70$).
- No correlation between satisfaction and understanding ($\rho_{\text{open-closed}}=0.44$, $\rho_{\text{open-mold}}=0.59$).

Results: Context dependent Satisfaction



When not actively listening or listening to music open is preferred to closed. Satisfaction seems highest with molds when talking to people.

For voices, traffic or machines in the background, satisfaction is higher with open coupling than with closed coupling and/or mold. For household noise and situations with no background noise the satisfaction is highest for molds.

Conclusions

- Speech understanding better for closed coupling and mold than for open domes. No such difference for satisfaction.
- Similar results between GöSa and EMA understanding ratings
- Mean satisfaction ratings correlate more with sound quality than with understanding
- Satisfaction is situation dependent: When not actively listening or when navigating in traffic, open coupling preferred to closed. When listening to people, higher satisfaction with molds.